Math 124 C - Spring 2010
Mid-Term Exam Number One
April 27, 2010

Name: _____ Student ID no. : _____

Signature: _____ Section: _____

1	15	
2	20	
3	10	
4	10	
5	10	
6	10	
Total	75	

- Complete all questions.
- You may use a scientific calculator during this examination; graphing calculators and other electronic devices are not allowed and should be turned off for the duration of the exam.
- If you use trial-and-error, a guess-and-check method, or numerical approximation when an exact method is available, you will not receive full credit.
- You may use one double-sided, hand-written, 8.5 by 11 inch page of notes.
- Show all work for full credit.
- You have 80 minutes to complete the exam.

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1. Determine the values of the following limits or state that the limit does not exist. If it is correct to say that the limit equals ∞ or $-\infty$, then you should do so.

   (a) $\lim_{x \to 5} \dfrac{x^3 - 25x}{3x^2 - 15x}$

   (b) $\lim_{x \to \infty} \left(\sqrt{x + 3\sqrt{x}} - \sqrt{x} \right)$

   (c) $\lim_{x \to 0} \dfrac{e^x - x}{5\cos x + 3\sin x}$

2. Find the derivatives of the following functions. Please do not simplify your results.

(a) $f(x) = x^5 - 3x^4 + \sin(2x)$

(b) $f(x) = \dfrac{3x + e^x}{6 + \tan x}$

(c) $f(x) = x^5 \cos(3x^2 + x)$

(d) $f(x) = \dfrac{1}{x^2 + \sec x}$

3. An astronaut throws a rock downward off a cliff on a distant planet. After falling for t seconds, the rock's height (in meters) above the ground is given by

$$f(t) = \frac{15 - 2t}{t + 1}.$$

(a) What is the rock's average velocity from time $t = 1$ to $t = 3$ seconds?

(b) How high is the rock when it is falling at the rate of 2 meters per second?

4. There are two values of a such that the tangent line to the curve $y = f(x) = 5 - 2x^2$ at $(a, f(a))$ passes through the point $(3, 0)$. Find those two values.

5. Consider the following function, defined for all non-zero numbers a.

$$g(x) = \begin{cases} x + \frac{\sin x}{ax} & \text{if } x > 0, \\ \frac{1}{a} & \text{if } x = 0, \\ a\frac{|x|}{x} + e^x & \text{if } x < 0. \end{cases}$$

(a) Find $\lim_{x \to 0^+} g(x)$.

(b) Find $\lim_{x \to 0^-} g(x)$.

(c) Are there any values of a which makes $g(x)$ continuous everywhere? If so, give those values of a. If not, explain why there is no such a.

6. Give a quadratic function $f(x)$ whose graph passes through the points $(-1, -12)$ and $(3, 4)$, and has a tangent line with slope -2 at $(3, 4)$.